**1.** The diagram below shows a cell during mitosis.



What are the structures and stage of mitosis?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Stage of mitosis** | **Structure I** | **Structure II** |
| A. | metaphase | chromatid | nuclear membrane |
| B. | anaphase | centromere | plasma membrane |
| C. | anaphase | chromatid | nuclear membrane |
| D. | metaphase | centromere | plasma membrane |

(Total 1 mark)

**2.** What happens in crossing over?

A. Exchange of genetic material between homologous chromosomes

B. Exchange of genes during metaphase of mitosis

C. Random distribution of chromosomes during meiosis

D. Homologous chromosomes fail to separate during meiosis

(Total 1 mark)

**3.** Which of the following does **not** occur during interphase?

A. Replication

B. Translation

C. Cytokinesis

D. An increase in the number of mitochondria

(Total 1 mark)

**4.** The diagram below shows chromosomes during meiosis.



How many chromosomes and chiasmata are visible?

|  |  |  |
| --- | --- | --- |
|  | **Chromosomes** | **Chiasmata** |
| A. | 4 | 4 |
| B. | 2 | 4 |
| C. | 2 | 2 |
| D. | 4 | 2 |

(Total 1 mark)

**5.** Which events occur during the G1 phase and S phase of the cell cycle?

|  |  |  |
| --- | --- | --- |
|  | **G1 phase** | **S phase** |
| A. | DNA replicates | cell grows |
| B. | mitosis begins | cell divides |
| C. | cell divides | mitosis begins |
| D. | cell grows | DNA replicates |

(Total 1 mark)

**6.** How can cells in a multicellular organism differentiate?

A. They express some of their genes but not others.

B. They all have a different genetic composition.

C. Different cells contain a different set of chromosomes.

D. Different cells do not have some of the genes.

(Total 1 mark)

**7.** The following sequence of pictures, made using an electronic imaging technique, shows a cell undergoing division.



[Adapted by permission from Macmillan Publishers Ltd, Fuller, B G et al. 2008. “Midzone activation of aurora B in anaphase produces an intracellular phosphorylation gradient”. *Nature.* Vol 453.]

(a) State the stage of mitosis typified by image II.

......................................................................................................................................

(1)

(b) List **two** processes that involve mitosis.

......................................................................................................................................

......................................................................................................................................

(2)

(c) State the process that results in tumour (cancer) formation or development.

......................................................................................................................................

(1)

(d) Explain, using **one** example, how non-disjunction in meiosis can lead to changes in chromosome number.

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

(2)

(Total 6 marks)

**8.** *Up to two additional marks are available for the construction of your answers.*

**(2)**

(a) Explain why DNA must be replicated before mitosis and the role of helicase in DNA replication.

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

(4)

(b) Explain how the base sequence of DNA is conserved during replication.

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

(5)

(c) Describe the events that occur during mitosis.

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

(9)

(Total 20 marks)

**9.** *Up to two additional marks are available for the construction of your answers.*

**(2)**

(b) Outline the formation of chiasmata during crossing over.

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

(5)

(c) Explain how an error in meiosis can lead to Down syndrome.

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

......................................................................................................................................

(8)

(Total 20 marks)